

(12) **United States Patent**  
**Hozono**

(10) **Patent No.:** **US 9,357,090 B2**  
(45) **Date of Patent:** **May 31, 2016**

(54) **IMAGE PROCESSING DEVICE**

(56) **References Cited**

(71) Applicant: **KYOCERA Document Solutions Inc.,**  
Osaka-shi, Osaka (JP)

U.S. PATENT DOCUMENTS

(72) Inventor: **Tomohide Hozono,** Osaka (JP)

5,592,308 A \* 1/1997 Fujiwara ..... H04N 1/1013  
250/234  
7,072,082 B2 \* 7/2006 Yokota ..... H04N 1/0464  
250/208.1  
7,804,625 B2 \* 9/2010 Osakabe ..... H04N 1/1017  
358/474

(73) Assignee: **KYOCERA Document Solutions Inc.,**  
Osaka-shi (JP)

(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 0 days.

FOREIGN PATENT DOCUMENTS

JP 2013111842 A 6/2013

\* cited by examiner

(21) Appl. No.: **14/664,708**

(22) Filed: **Mar. 20, 2015**

*Primary Examiner* — Houshang Safaipoor

(74) *Attorney, Agent, or Firm* — Alleman Hall McCoy  
Russell & Tuttle LLP

(65) **Prior Publication Data**

US 2015/0281484 A1 Oct. 1, 2015

(30) **Foreign Application Priority Data**

Mar. 31, 2014 (JP) ..... 2014-073781

(51) **Int. Cl.**

**H04N 1/04** (2006.01)

**H04N 1/00** (2006.01)

(52) **U.S. Cl.**

CPC ..... **H04N 1/00549** (2013.01); **H04N 1/00557**  
(2013.01); **H04N 1/00559** (2013.01); **H04N**  
**2201/0081** (2013.01); **H04N 2201/0094**  
(2013.01)

(58) **Field of Classification Search**

CPC ..... H04N 1/00549; H04N 1/00559; H04N  
1/00557

USPC ..... 358/471, 474, 498, 497

See application file for complete search history.

(57) **ABSTRACT**

An image processing device according to one aspect of the present disclosure includes a moving body, a housing, a support portion, and a first contact portion. The moving body is composed of a resin member and has a surface on which a holding plate which holds an electric component used for image processing is mounted. The housing includes a pair of side walls between which the moving body is housed therein. The support portion is provided to the housing and configured to support the moving body such that the moving body is movable in a predetermined moving direction. The first contact portion is provided to the moving body, and is configured to be contactable with a contacted portion within the housing prior to the holding plate when the moving body reaches a contact position where it is possible to contact with the contacted portion.

**3 Claims, 11 Drawing Sheets**

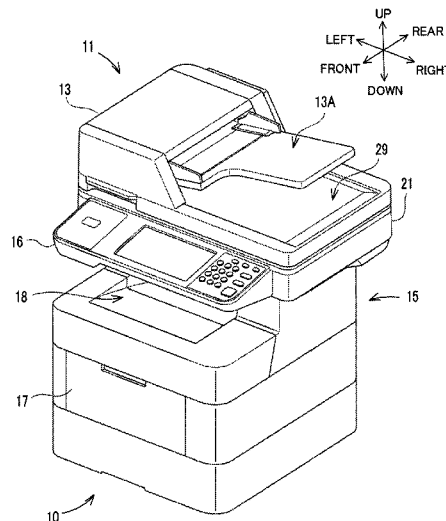


FIG. 1

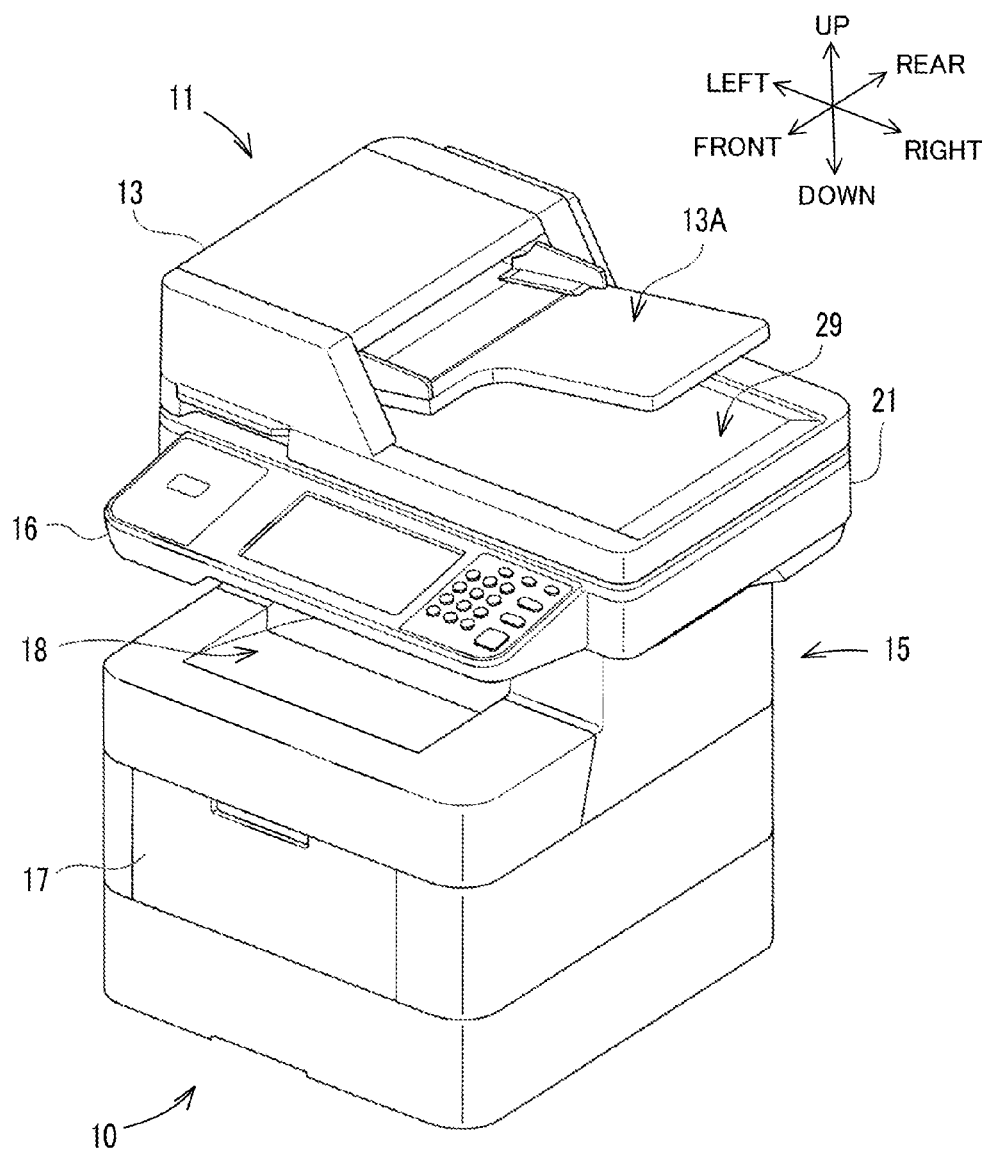


FIG. 2A

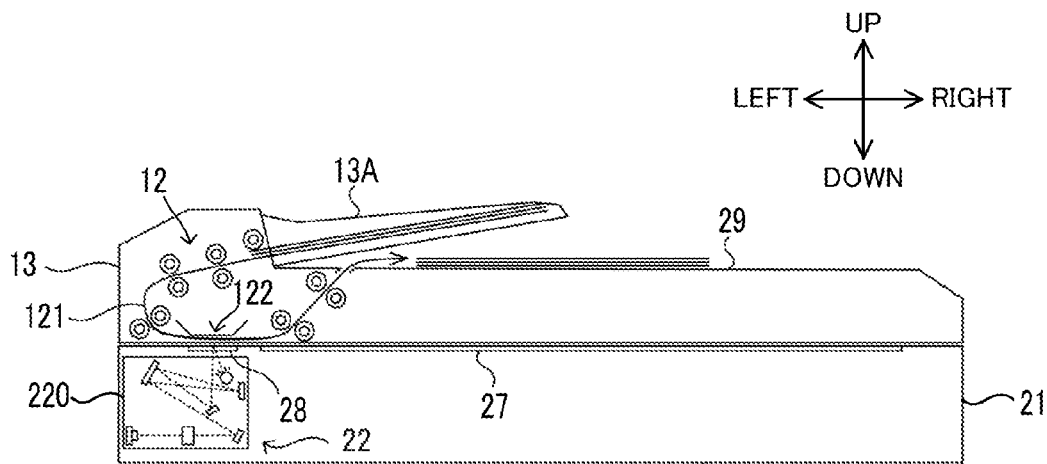


FIG. 2B

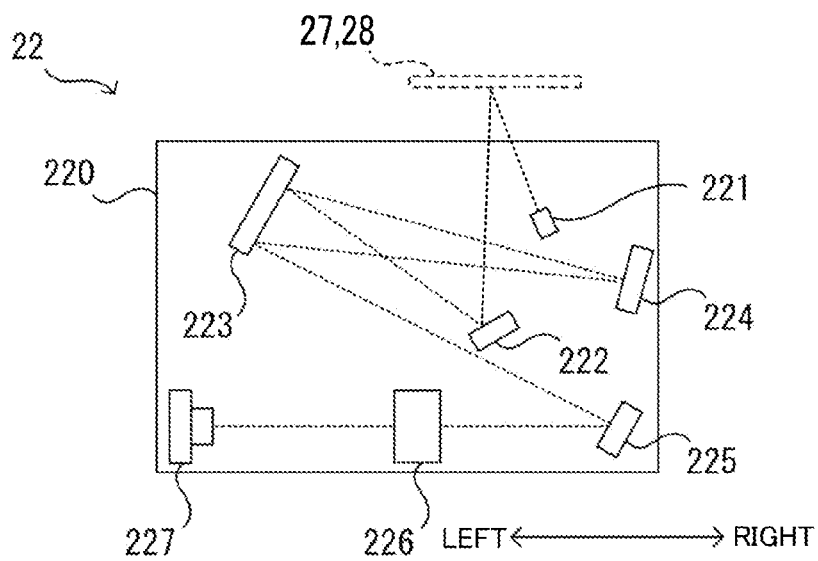


FIG. 3

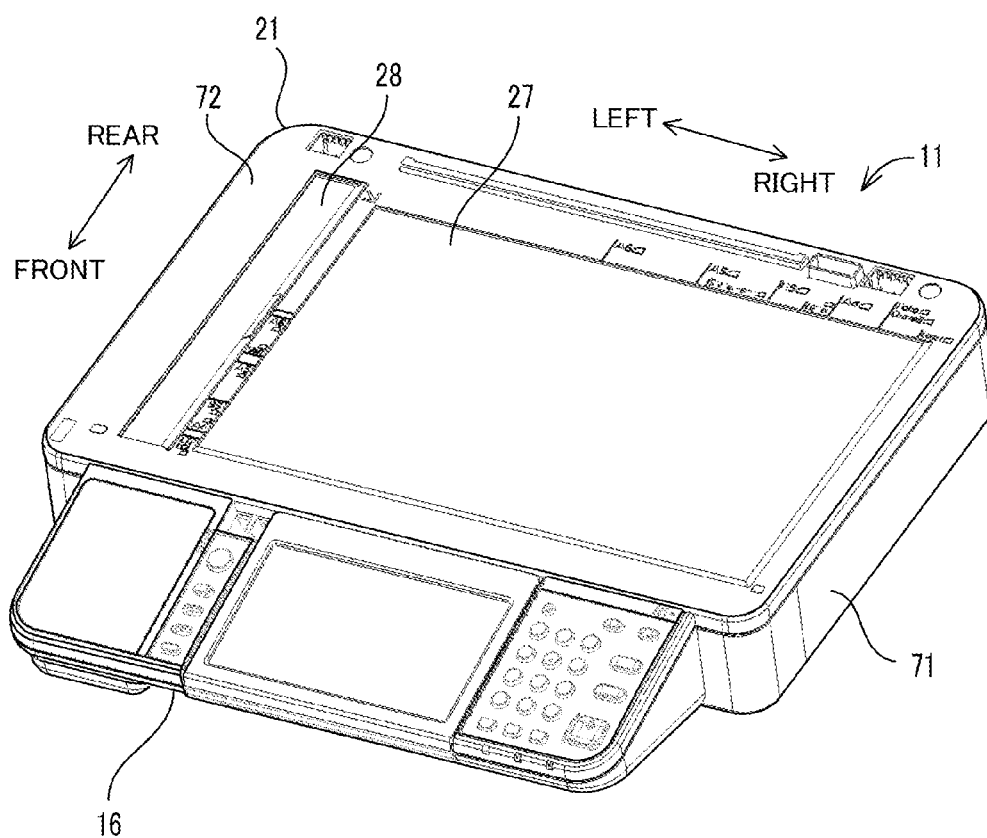


FIG. 4

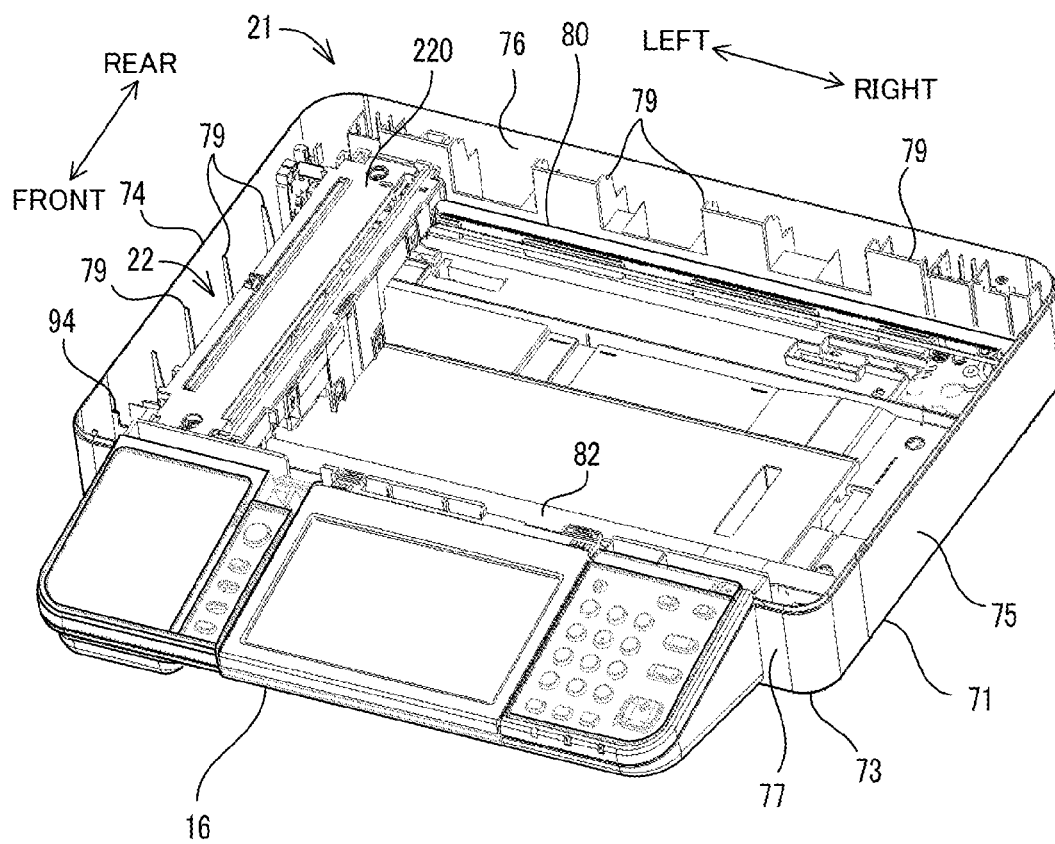


FIG. 5

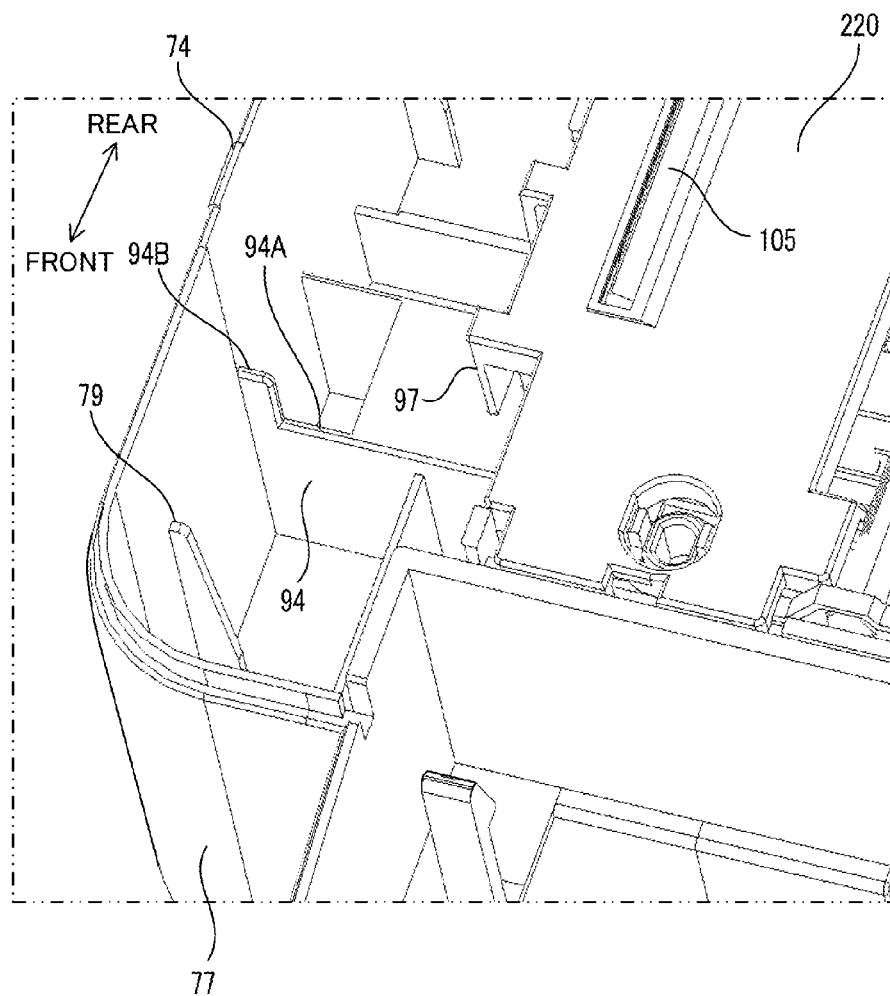


FIG. 6

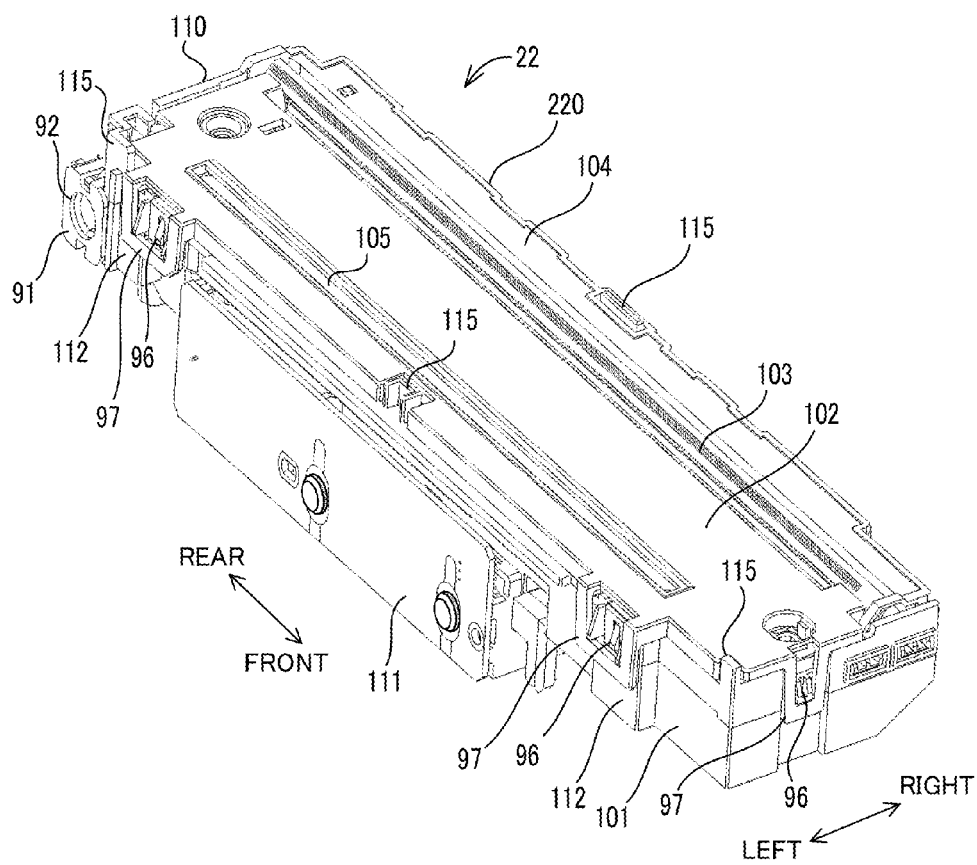


FIG. 7

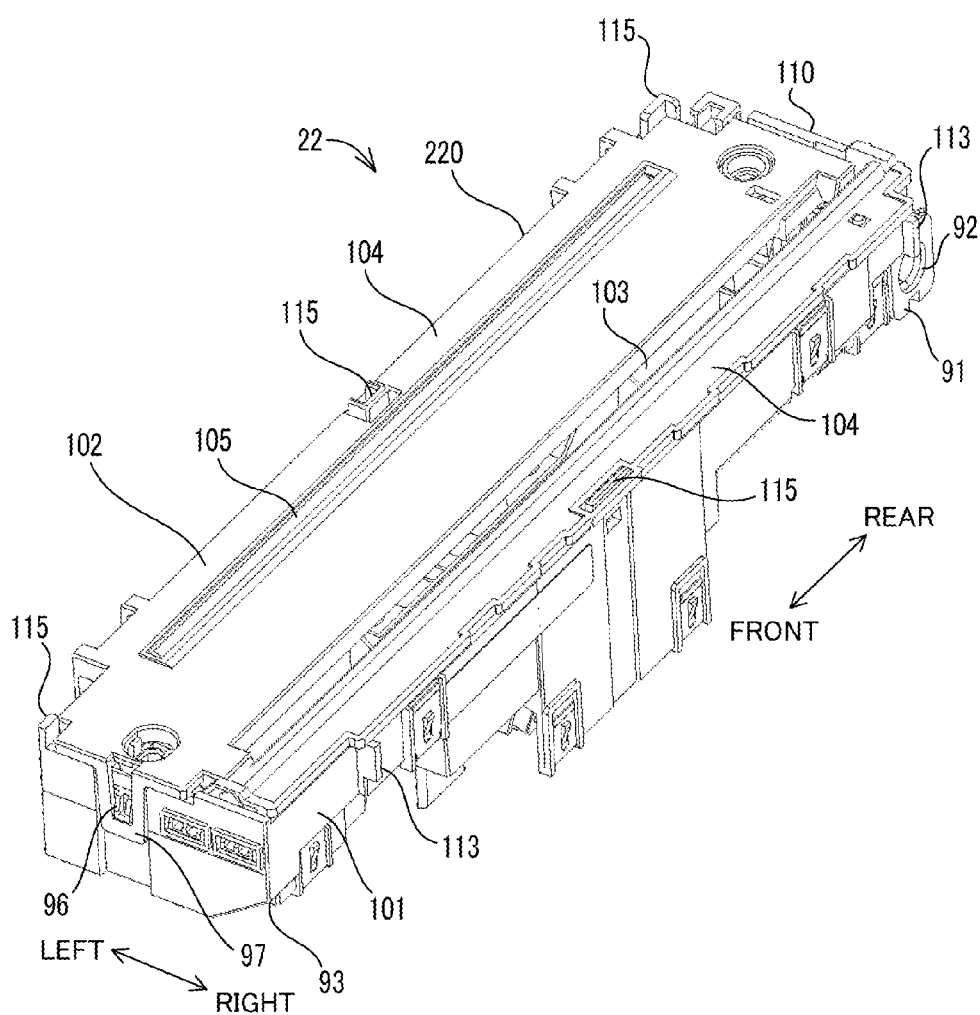




FIG. 8

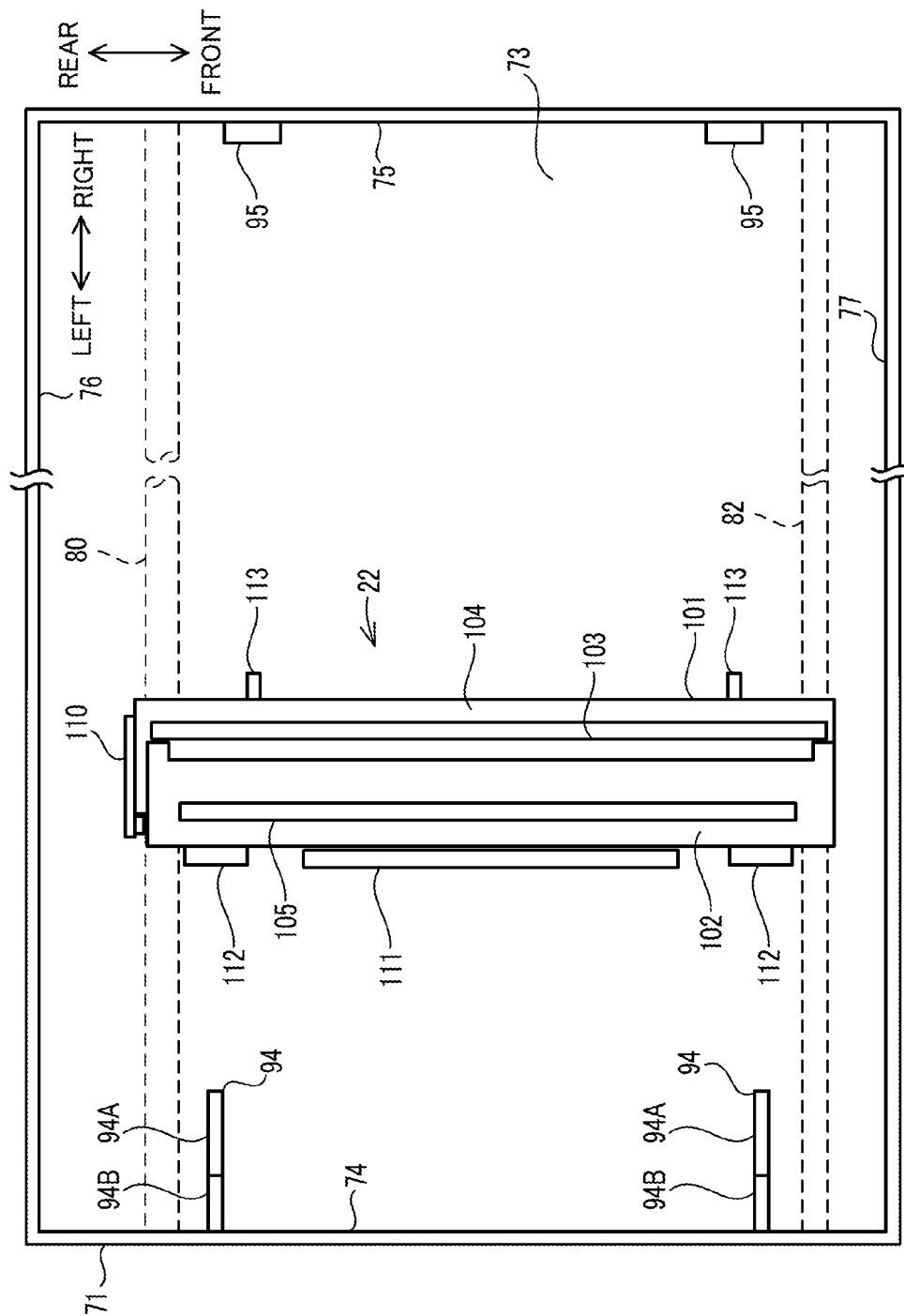


FIG. 9

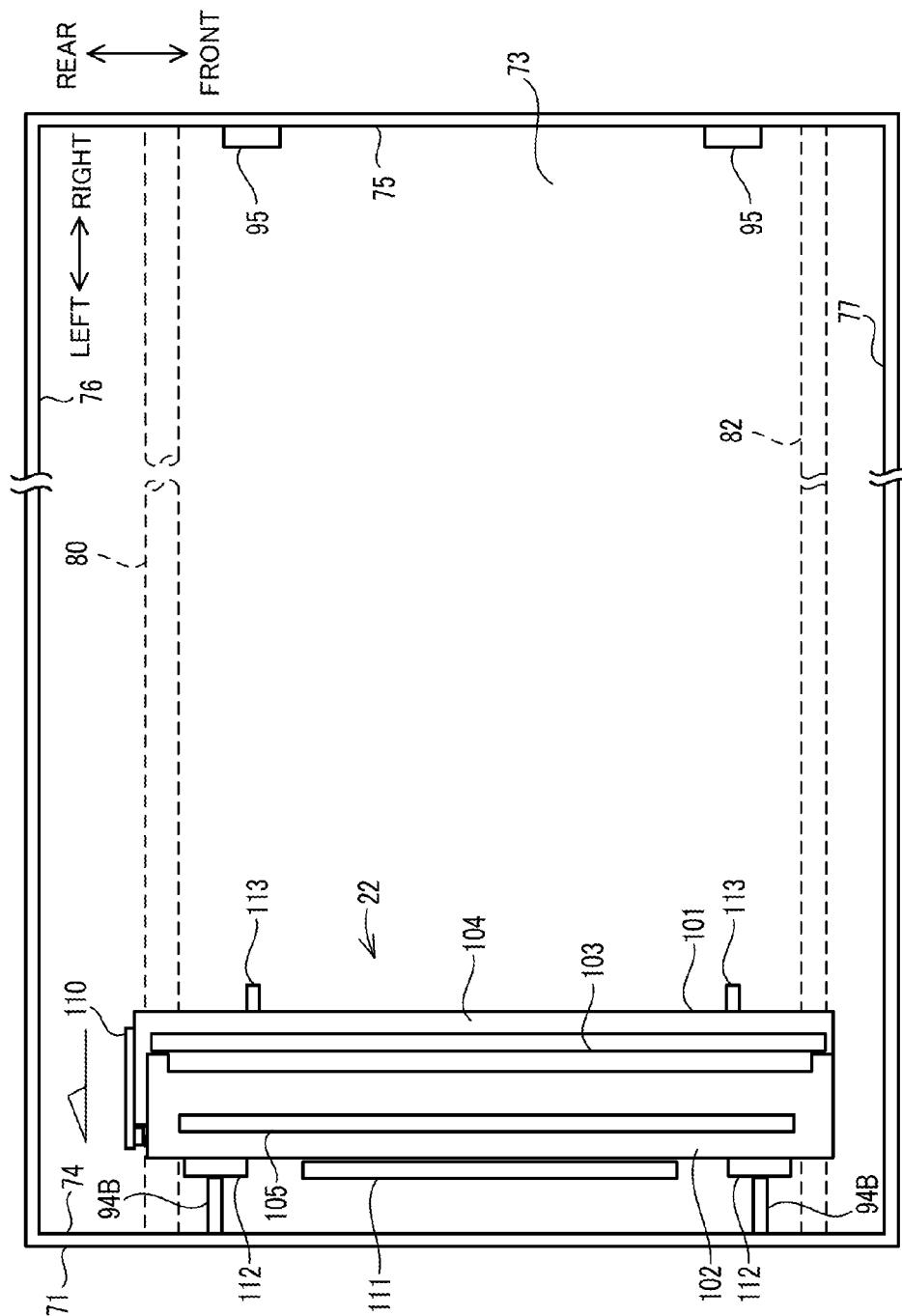
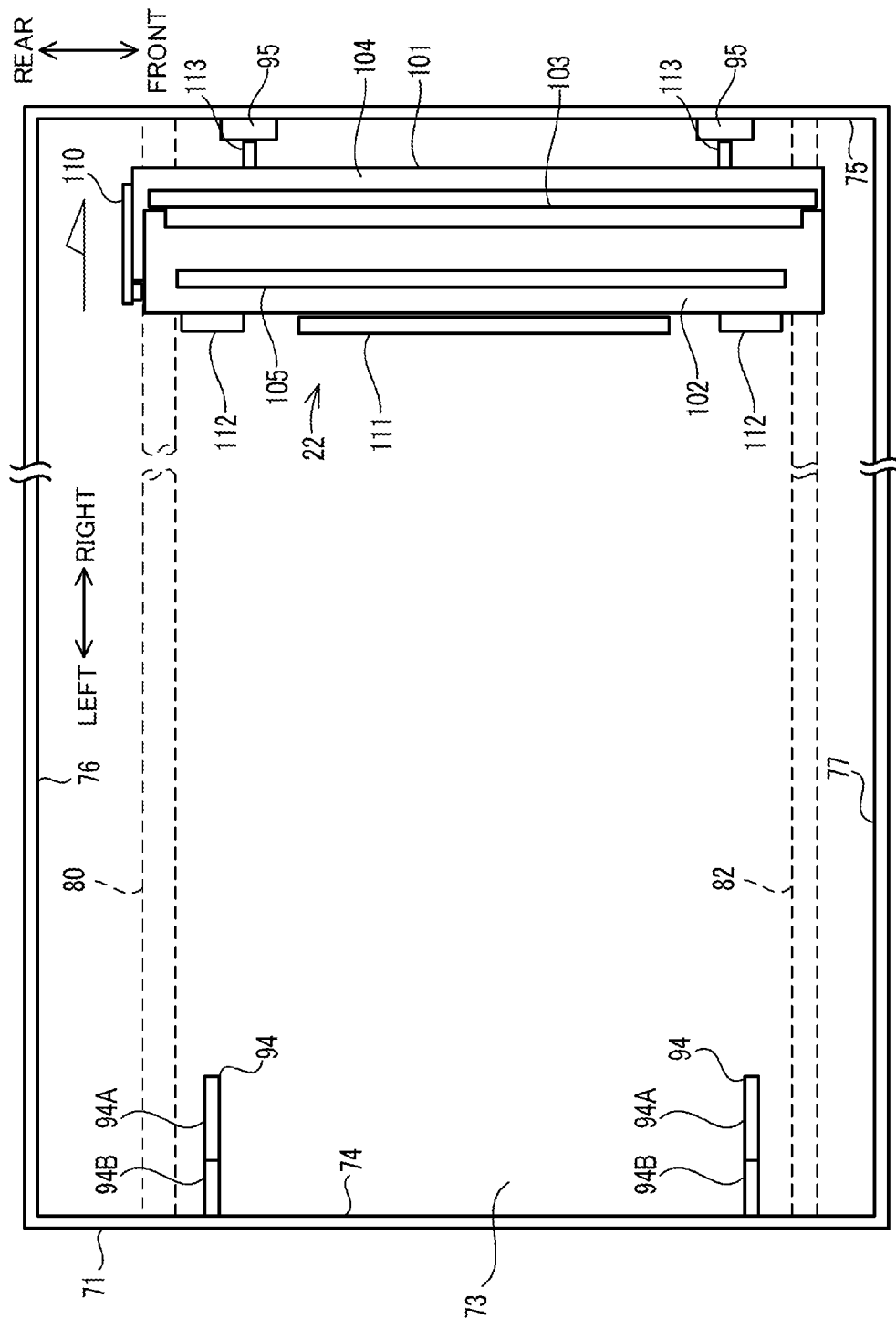
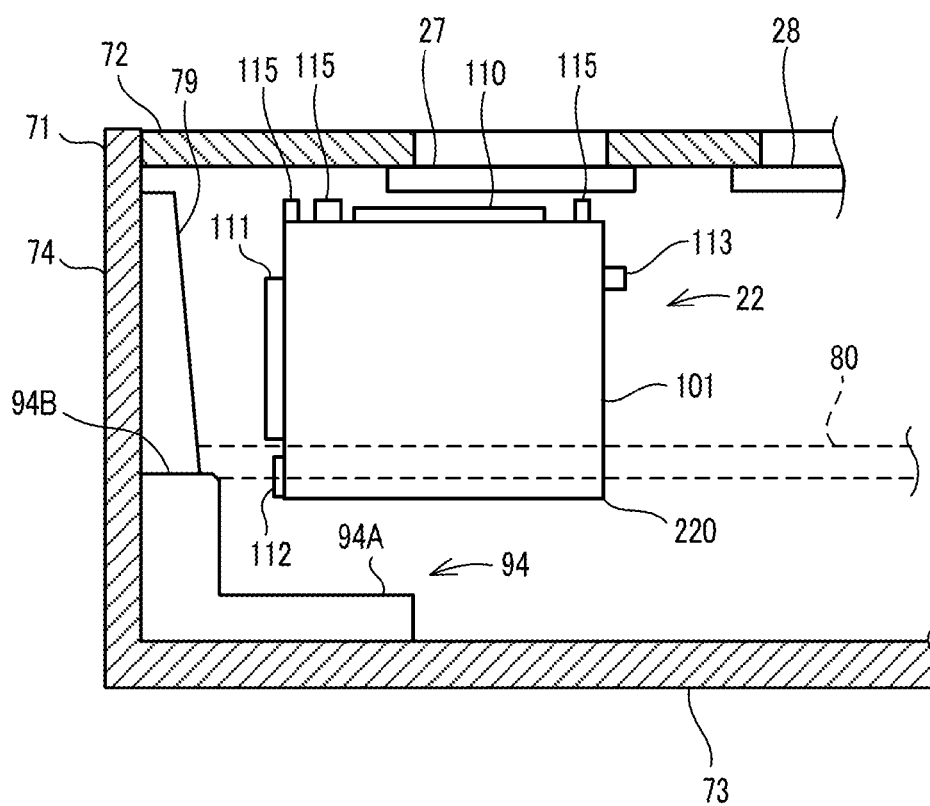


FIG. 10





1

**IMAGE PROCESSING DEVICE****INCORPORATION BY REFERENCE**

This application is based upon and claims the benefit of  
priority from the corresponding Japanese Patent Application  
No. 2014-073781 filed on Mar. 31, 2014, the entire contents  
of which are incorporated herein by reference.

**BACKGROUND**

The present disclosure relates to an image processing  
device such as an image reading device which includes a  
moving body having a surface on which a holding plate which  
holds an electric component used for image processing is  
mounted.

A conventional image reading device includes a reading  
unit which includes: a reading sensor in which a plurality of  
image sensors are arranged in a main-scanning direction; a  
light emitting element such as an LED which applies light to  
an imaging target; optical components such as a lens and a  
mirror; and the like. The reading unit includes a carriage  
(moving body) composed of a resin member. The reading  
sensor, the light emitting element, the optical components,  
and the like are mounted in the carriage, and a drive substrate  
(holding plate) for driving the reading sensor and the light  
emitting element is also mounted in the carriage. The carriage  
is housed within a housing of the image reading device and  
supported so as to be movable in a sub-scanning direction (a  
direction perpendicular to the main-scanning direction) along  
a guide shaft provided within the housing. In the image read-  
ing device, an image on a document sheet placed on a docu-  
ment table is read by causing the reading sensor to perform a  
reading operation while moving the carriage in the sub-scann-  
ing direction.

Meanwhile, when the image reading device is transported,  
if the carriage freely moves, the carriage may collide against  
an internal frame of the housing and be damaged. Thus,  
hitherto, for example, a configuration in which the carriage is  
fixed at a non-contact position by means of a fixing member,  
and a configuration in which a shock absorbing member is  
provided between the carriage and the internal frame for  
alleviating a shock, are known.

**SUMMARY**

An image processing device according to one aspect of the  
present disclosure includes a moving body, a housing, a sup-  
port portion, and a first contact portion. The moving body is  
composed of a resin member and has a surface on which a  
holding plate which holds an electric component used for  
image processing is mounted. The housing includes a pair of  
side walls between which the moving body is housed therein.  
The support portion is provided to the housing and configured  
to support the moving body such that the moving body is  
movable in a predetermined moving direction. The first con-  
tact portion is provided to the moving body, and is configured  
to be contactable with a contacted portion within the housing  
prior to the holding plate when the moving body reaches a  
contact position where it is possible to contact with the con-  
tacted portion.

This Summary is provided to introduce a selection of con-  
cepts in a simplified form that are further described below in  
the Detailed Description with reference where appropriate to  
the accompanying drawings. This Summary is not intended to  
identify key features or essential features of the claimed sub-  
ject matter, nor is it intended to be used to limit the scope of

2

the claimed subject matter. Furthermore, the claimed subject  
matter is not limited to implementations that solve any or all  
disadvantages noted in any part of this disclosure.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a perspective view showing an image forming  
apparatus including an image reading device according to an  
embodiment of the present disclosure.

FIGS. 2A and 2B are diagrams showing the internal con-  
figuration of the image reading device.

FIG. 3 is a perspective view showing the image reading  
device.

FIG. 4 is a perspective view showing the internal configu-  
ration of a housing of the image reading device.

FIG. 5 is a partially enlarged view of the housing.

FIG. 6 is a perspective view showing a reading unit of the  
image reading device.

FIG. 7 is a perspective view showing the reading unit of the  
image reading device.

FIG. 8 is a diagram showing the position of the reading unit  
in the housing.

FIG. 9 is a diagram showing the position of the reading unit  
in the housing.

FIG. 10 is a diagram showing the position of the reading  
unit in the housing.

FIG. 11 is a diagram showing a positional relationship  
between the reading unit and contact glasses.

**DETAILED DESCRIPTION**

Hereinafter, an embodiment of the present disclosure will  
be described with reference to the drawings. It should be  
noted that the embodiment described below is merely an  
example embodying the present disclosure, and does not limit  
the technical scope of the present disclosure.

First, an image reading device 11 which is an example of an  
image processing device according to the embodiment of the  
present disclosure, and the configuration of an image forming  
apparatus 10 which includes the image reading device 11 will  
be described with reference to FIGS. 1, 2A, and 2B. The  
image forming apparatus 10 is a multifunction peripheral  
having an image reading function, a facsimile function, an  
image forming function, and the like. As shown in FIG. 1, the  
image forming apparatus 10 includes the image reading  
device 11, an ADF (Auto Document Feeder) 13, an image  
forming portion 15, an operation display portion 16, a sheet  
feed cassette 17, and a sheet discharge portion 18. It should be  
noted that in the present embodiment, the image forming  
apparatus 10 including the image reading device 11 which is  
an example of the image processing device according to the  
present disclosure is described as an example, but the present  
disclosure is not limited thereto. For example, in the present  
disclosure, the image reading device 11 may be independent  
as an image processing device from the image forming appa-  
ratus 10, or a facsimile apparatus or a copying machine may  
include the image reading device 11.

The image forming portion 15 executes a color or mono-  
chrome image forming process (printing process) in accord-  
ance with an electrophotographic method. The image form-  
ing portion 15 executes the image forming process on the  
basis of image data read by the image reading device 11 or  
image data inputted thereto from an information processing  
apparatus such as an external personal computer or the like.  
The image forming portion 15 includes an image forming  
unit, an exposure device, an intermediate transfer belt, a sec-  
ondary transfer roller, a fixing device, and the like.

3

The ADF 13 is provided to the image reading device 11. The ADF 13 takes out, one by one, document sheets placed on a document set portion 13A, and sequentially conveys the document sheets along a conveyance path 12 to an image reading position 122 of the image reading device 11. Thus, the image reading device 11 is allowed to read image data from each document sheet being conveyed by the ADF 13. Here, the conveyance path 12 is a path extending sequentially through: a turn-around portion 121 at which a document conveyance direction is reversed; and the predetermined image reading position 122. The image reading position 122 is a position at which an image on a document sheet can be read by the image reading device 11, and is a position irradiated with light by a later-described reading unit 22.

The image reading device 11 is mounted on an upper portion of the image forming apparatus 10. The image reading device 11 reads image data from a document sheet. As shown in FIG. 2A, the image reading device 11 includes the reading unit 22, a contact glass 27 (an example of a sheet placement plate of the present disclosure), a contact glass 28, a document holder 29, a housing 21, and the like. These components are housed within the housing 21 which forms a housing of the image reading device 11. The housing 21 will be described in detail later.

Both the contact glass 27 and the contact glass 28 are mounted on an upper portion of the housing 21. The contact glass 27 is a region in which a document sheet (sheet member) which is an image reading target is placed. The contact glass 28 is a region which allows light emitted from the reading unit 22 to a document sheet being conveyed by the ADF 13 to be transmitted therethrough.

As shown in FIG. 2B, the reading unit 22 includes a light source 221, mirrors 222 to 225, an optical lens 226, an image sensor 227, and the like. These optical components are housed within a carriage 220 (an example of a moving body of the present disclosure) which forms a housing of the reading unit 22. The carriage 220 will be described in detail later.

The light source 221 includes a large number of white LEDs arranged along a main-scanning direction (a front-rear direction in FIG. 1). The carriage 220 of the reading unit 22 is configured to be movable in a sub-scanning direction (a right-left direction in FIG. 2A) by a conventionally-known moving mechanism using a drive device (electric motor) such as a stepping motor or the like. The moving mechanism is, for example, a belt transmission mechanism or a gear transmission mechanism which transmits a driving force from the motor to the carriage 220. In the image reading device 11, when a document sheet is placed on the contact glass 27 and the document holder 29 is closed, the reading unit 22 is moved within the housing 21 relative to the document sheet in the sub-scanning direction by the drive device. During the movement of the reading unit 22, scanning is performed in the sub-scanning direction with the light applied from the light source 221 to the contact glass 27. Thus, an image on the document sheet is read. In addition, in the image reading device 11, in reading an image from a document sheet being conveyed by the ADF 13, the reading unit 22 is moved to a position at which the light of the light source 221 is applied to the contact glass 28, that is, to a position below the contact glass 28. Then, during the conveyance of the document sheet, the light is applied from the light source 221 of the reading unit 22 to the contact glass 28. Thus, an image on the document sheet is read.

Specifically, when the reading unit 22 receives reflected light from the document sheet, the reflected light is reflected toward the mirror 222. The mirrors 222 to 225 are reflection mirrors which guide the reflected light which has been emitted

4

from the light source 221 and reflected on the document sheet, to the optical lens 226. The reflected light is reflected sequentially on the mirror 222, the mirror 223, the mirror 224, the mirror 223, and the mirror 225 and guided to the optical lens 226 as shown by a dotted line in FIG. 2B. The optical lens 226 causes the light entering from the mirror 225 to be converged on and enter the image sensor 227. The image sensor 227 is an image sensor having a photoelectric conversion element. The image sensor 227 inputs an electric signal based on the reflected light, as image data of the document sheet to a control portion which is not shown.

Hereinafter, the housing 21 and the reading unit 22 will be described in detail with reference to FIGS. 3 to 11.

As shown in FIGS. 3 and 4, the housing 21 is the housing of the image reading device 11. The housing 21 is connected to an upper portion of a housing of the image forming portion 15. The housing 21 forms a part of a housing of the image forming apparatus 10 by being mounted on the housing of the image forming portion 15 and the like.

As shown in FIG. 3, the housing 21 includes a lower frame 71 and an upper frame 72. Each of the lower frame 71 and the upper frame 72 is a molded article formed from a synthetic resin. As shown in FIG. 4, the lower frame 71 is a member which forms a bottom surface and side surfaces of the housing 21. Specifically, the lower frame 71 includes: a flat bottom plate 73 having a rectangular shape which is long in the right-left direction; and four side plates 74 to 77 erected from four edge sides of the bottom plate 73. In other words, the housing 21 includes a pair of the side plates 74 and 75 (an example of side walls of the present disclosure) which are spaced apart from each other in a longitudinal direction and opposed to each other; and a pair of the side plates 76 and 77 which are spaced apart from each other in a lateral direction and opposed to each other. The reading unit 22 is housed within the internal space of the lower frame 71, that is, within a space surrounded by the bottom plate 73 and the four side plates 74 to 77.

As shown in FIG. 3, the upper frame 72 is formed in a rectangular shape which is long in the right-left direction so as to correspond to the shape of the lower frame 71. The upper frame 72 is mounted on an upper portion of the lower frame 71, thereby covering an upper opening of the lower frame 71. The upper frame 72 is fitted and mounted, from above, to upper end portions of the side plates 74 to 77 which are an edge portion of the upper opening of the lower frame 71.

The upper frame 72 has two openings formed so as to be spaced apart from each other in the right-left direction. The contact glass 28 is mounted at an outer edge of the left opening, and the contact glass 27 is mounted at an outer edge of the right opening. Specifically, each of the contact glasses 27 and 28 is joined to a lower surface of the outer edge of the corresponding opening by means of an adhesive member such as a double-sided adhesive tape. In addition, when the upper frame 72 is mounted on the lower frame 71, the lower surfaces of the contact glasses 27 and 28 are supported by support ribs 79 formed on the inner surfaces of the side plates 74 to 77, and the like from the lower side. Thus, the contact glasses 27 and 28 are vertically interposed and fixed between the upper frame 72 and the support ribs 79 of the lower frame 71.

As shown in FIG. 4, a support shaft 80 and a support rail 82 are provided to the lower frame 71. The support shaft 80 and the support rail 82 are an example of a support portion of the present disclosure. The support shaft 80 and the support rail 82 support the carriage 220 of the reading unit 22 such that the carriage 220 is movable in the sub-scanning direction. The support shaft 80 is a round-bar-like member provided so as to extend between the pair of the side plates 74 and 75. The

5

support shaft **80** is provided at a position close to the side plate **76**, that is, at the rear side of the lower frame **71** in FIG. **4**. The support shaft **80** is fixed at one end thereof to the side plate **74** and at the other end thereof to the side plate **75**. The support shaft **80** is inserted through a later-described guide hole **92** (see FIG. **6**) of the carriage **220**. Since the support shaft **80** is inserted through the guide hole **92**, the carriage **220** is made movable in the sub-scanning direction along the support shaft **80**. The support rail **82** is a member which is long in the sub-scanning direction and erected upward on the bottom plate **73**. The support rail **82** is provided so as to connect the pair of the side plates **74** and **75**. The support rail **82** is provided at a position close to the side plate **77**, that is, at the front side of the lower frame **71** in FIG. **4**. The support rail **82** supports a rail guide **93** (see FIG. **7**, an example of a supported portion of the present disclosure) provided on a lower surface of one end portion of the carriage **220** in the main-scanning direction, such that the rail guide **93** is slidable in the sub-scanning direction. Since the support shaft **80** and the support rail **82** are provided to the lower frame **71** as described above, the carriage **220** is supported so as to be movable in the sub-scanning direction.

As shown in FIGS. **4** and **5**, a projection rib **94** (an example of a contacted portion of the present disclosure) is provided to the lower frame **71**. In the present embodiment, two projection ribs **94** are provided to the lower frame **71**. The two projection ribs **94** are provided on the inner surface of the side plate **74**. It should be noted that in FIGS. **4** and **5**, only one of the projection ribs **94** provided to the side plate **74** is shown, and the other projection rib **94** is not shown. As shown in FIG. **5**, the one projection rib **94** is provided at the front side on the side plate **74**. In addition, the other projection rib **94** is provided at the rear side on the side plate **74** (see FIG. **8**). The projection ribs **94** project from the inner surface of the side plate **74** in a direction perpendicular to the inner surface of the side plate **74**. Each projection rib **94** is formed in a plate rib shape extending upward from the bottom plate **73** and is formed so as to be integrated with the lower frame **71**. Each projection rib **94** has steps, that is, a lower step **94A** at a lower position and an upper step **94B** at a position above the lower step **94A**. The lower step **94A** extends in the sub-scanning direction. The upper step **94B** projects in a movement range of the carriage **220**. As described later, the upper step **94B** is configured to be brought into contact with a part of the carriage **220** when the carriage **220** moves toward the left side of the lower frame **71** to a position at which the carriage **220** comes into contact with the side plate **74**.

As shown in FIG. **8**, a stopper portion **95** (an example of the contacted portion of the present disclosure) is provided to the lower frame **71**. In the present embodiment, two stopper portions **95** are provided to the lower frame **71**. The two stopper portions **95** are provided on the inner surface of the side plate **75**. Each stopper portion **95** projects from the inner surface of the side plate **75** by an amount equal to the thickness of the side plate **75**, and has an inner surface formed in a flat rectangular shape. One of the stopper portions **95** is provided at the front side on the side plate **75**. In addition, the other stopper portion **95** is provided at the rear side on the side plate **75**. Each stopper portion **95** is formed so as to be integrated with the lower frame **71**. Each stopper portion **95** is provided in the movement range of the carriage **220**. As described later, each stopper portion **95** is configured to be brought into contact with a part of the carriage **220** when the carriage **220** moves toward the right side of the lower frame **71** to a position at which the carriage **220** comes into contact with the side plate **75**. It should be noted that the stopper portions **95** may not be provided and a part of the carriage **220**

6

may be brought into contact with the inner surface of the side plate **75**. In this case, the side plate **75** corresponds to the contacted portion of the present disclosure.

As shown in FIGS. **6** and **7**, the reading unit **22** includes the carriage **220** which forms the housing thereof. The carriage **220** is a molded article formed from a synthetic resin. The carriage **220** includes a main body portion **101** and a cover **102**. The main body portion **101** is formed in a rectangular parallelepiped shape which is long in a direction which coincides with the main-scanning direction. In other words, the main body portion **101** is formed in a shape which is long in the main-scanning direction perpendicular to the sub-scanning direction which is the moving direction of the carriage **220**. The optical components such as the light source **221**, the mirrors **222** to **225**, and the like are housed within the main body portion **101**.

The cover **102** is mounted on an upper surface of the main body portion **101**. An opening is formed in the upper surface of the main body portion **101**, and a plurality of hooks **96** are provided to an edge portion of the opening. In addition, engagement pieces **97** are provided to the cover **102**, are located at positions corresponding to the hooks **96**, and have grooves engageable with the hooks **96**. When the cover **102** is overlaid on the upper surface of the main body portion **101** and then the engagement pieces **97** are engaged with the hooks **96**, the cover **102** is mounted on the main body portion **101**.

A mounting plate **104** (an example of a holding plate of the present disclosure) on which the light source **221** is mounted is provided at one side in a lateral direction of the cover **102**. The mounting plate **104** has light emitting elements such as LEDs mounted thereon so as to be aligned in the main-scanning direction. The mounting plate **104** is exposed on an upper surface of the carriage **220**. In addition, the cover **102** has a narrow slit **103** formed so as to extend in a longitudinal direction thereof. The slit **103** is a through hole for guiding the light emitted from the light source **221**, to the outside, and is covered with a light-transmitting plate member from the inner side. In addition, the cover **102** has a narrow slit **105** formed so as to extend in the longitudinal direction thereof. The slit **105** is a through hole for receiving reflected light from a document sheet and guiding the reflected light to the inner mirror **222**, and is covered with a light-transmitting plate member from the inner side.

A guide portion **91** is provided at a lower portion of an end portion at the rear side in the longitudinal direction (a rear end portion) of the main body portion **101** and has the guide hole **92** through which the support shaft **80** is inserted. The guide hole **92** penetrates in the lateral direction of the carriage **220**, and the support shaft **80** is inserted through the guide hole **92**. In addition, the rail guide **93** is provided at a lower portion of an end portion at the front side in the longitudinal direction (a front end portion) of the main body portion **101** and is supported by an upper end of the support rail **82**. The rail guide **93** is provided on a lower surface of the front end portion. In a state where the support shaft **80** is inserted through the guide hole **92**, the rail guide **93** is placed on the upper end of the support rail **82**, whereby the rail guide **93** is slidably supported by the support rail **82**. Since the carriage **220** is supported by the support shaft **80** and the support rail **82** as described above, the front end portion of the carriage **220** is rotatable upward about the support shaft **80** if there are no other limitations. However, as shown in FIG. **3**, the contact glasses **27** and **28** are provided above the carriage **220**. Thus, if the front end portion is about to rotate upward upon reception of an external force caused by vibration, shake, shock, or

7

the like, the upward rotation of the front end portion is limited by the contact glasses 27 and 28.

An aluminum substrate 110 (an example of the holding plate of the present disclosure) formed of an aluminum plate is mounted on a side surface of the rear end portion of the main body portion 101. An LED driver for controlling lighting of the LEDs as the light source 221 is mounted on the aluminum substrate 110. The LED driver is composed of an electric component such as an IC which implements a constant current drive circuit, a PWM control circuit, or the like. In addition, a printed substrate 111 (an example of the holding plate of the present disclosure) is mounted on a side surface (left side surface) of an end portion at the left side in the lateral direction (left end portion) of the main body portion 101. The printed substrate 111 is provided at the center of the left side surface of the main body portion 101. The image sensor 227 and a driver for driving and controlling the image sensor 227 are mounted on the printed substrate 111. In addition, electric components such as a sensor for detecting the position of the carriage 220 and the like are mounted on the printed substrate 111.

In the case where holding plates which hold electric components, such as the mounting plate 104, the aluminum substrate 110, and the printed substrate 111, are mounted on the surface of the carriage 220 as described above, if the carriage 220 moves and the holding plate comes into contact with an internal frame of the housing 21 during transportation of the image forming apparatus 10, the holding plate or the electric component may be damaged or broken down due to a shock at the time of contact. It is possible to prevent such contact by providing a fixing member which fixes the carriage 220 at a non-contact position. However, additional components such as the fixing member are required. In addition, a problem arises that a complicated mounting operation is involved in which the carriage 220 is moved to the non-contact position and then is fixed at that position by using the fixing member. It is possible to alleviate such a shock by providing a shock absorbing member to the carriage 220 or the internal frame. However, the component cost of the shock absorbing member is added to the manufacturing cost, and further the assembling cost is increased. In particular, in the case where substrates such as the aluminum substrate 110 and the printed substrate 111 are mounted on the surface of the carriage 220, during an operation of mounting the fixing member, the fixing member may come into direct contact with each substrate to damage the substrate. In addition, unless the carriage 220 is fixed by means of the fixing member, the carriage 220 moves, and the substrate comes into contact with the internal frame of the housing 21, so that the substrate is damaged. Moreover, even in the case where the shock absorbing member is provided, if the carriage 220 moves and the substrate comes into direct contact with the shock absorbing member, the substrate receives a shock from the shock absorbing member. If the shock is repeated, the substrate may be damaged or the electric component may malfunction. Thus, in the present embodiment, a configuration is provided such that the holding plate is prevented from coming into direct contact with the internal frame even when the carriage 220 moves due to vibration, shake, or the like during transportation of the image forming apparatus 10 for shipping the image forming apparatus 10. Thus, even if the carriage 220 comes into contact with the internal frame or the like within the housing 21, it is possible to prevent damage of the substrate mounted on the carriage 220 or breakdown of the electric component with a cheap and simple configuration.

Specifically, as shown in FIG. 6, two contact portions 112 (an example of a first contact portion of the present disclosure)

8

are provided on the left side surface of the main body portion 101 of the carriage 220 (a side surface of the carriage 220 at the moving direction side) so as to be contactable with the upper steps 94B of the projection ribs 94. The two contact portions 112 are provided at positions on the left side surface which are spaced apart from each other in the longitudinal direction of the main body portion 101. Specifically, the two contact portions 112 are provided at positions away from both sides of the printed substrate 111, respectively. The contact portions 112 are provided at positions corresponding to the upper steps 94B provided to the side plate 74 of the lower frame 71. Since such contact portions 112 are provided, as shown in FIG. 9, even if, during transportation of the image forming apparatus 10 in shipping the image forming apparatus 10, the carriage 220 moves and reaches a first position (a position shown in FIG. 9) where it is possible to contact with the projection ribs 94 of the lower frame 71, the contact portions 112 come into contact with the upper steps 94B prior to the printed substrate 111. That is, since the contact portions 112 come into contact with the upper steps 94B at the first position, the printed substrate 111 does not come into direct contact with the upper steps 94B, the side plate 74, and the like. Thus, the printed substrate 111 does not receive a shock caused by direct contact, and thus damage of the printed substrate 111 and breakdown of electric components such as the image sensor 227 and the driver for the image sensor 227 which are components mounted on the printed substrate 111 are prevented. It should be noted that the first position corresponds to a contact position of the present disclosure.

In addition, as shown in FIG. 7, two projections 113 (an example of the first contact portion of the present disclosure) are provided on a right side surface of the main body portion 101 of the carriage 220 (a side surface of the carriage 220 at the moving direction side) so as to be contactable with the stopper portions 95. The two projections 113 are provided at positions on the right side surface which are spaced apart from each other in the longitudinal direction of the main body portion 101. The projections 113 are provided at positions corresponding to the positions of the stopper portions 95 provided to the side plate 75 of the lower frame 71. The projections 113 project from the right side surface of the main body portion 101 in a direction perpendicular to the right side surface, and projection ends thereof extend rightward further than a right end portion of the mounting plate 104, so that the projections 113 project to positions beyond the mounting plate 104. In the present embodiment, the projections 113 project most on the right side surface of the carriage 220. Since such projections 113 are provided, as shown in FIG. 10, even if, during transportation of the image forming apparatus 10 in shipping the image forming apparatus 10, the carriage 220 moves and reaches a second position (a position shown in FIG. 10) where it is possible to contact with the stopper portions 95 of the lower frame 71, the projections 113 come into contact with the stopper portions 95 prior to the mounting plate 104. That is, since the projections 113 come into contact with the stopper portions 95 at the second position, the mounting plate 104 does not come into direct contact with the stopper portions 95, the side plate 75, and the like. Thus, the mounting plate 104 does not receive a shock caused by direct contact, and thus damage of the mounting plate 104 and breakdown of electric components such as the LEDs which are components mounted on the mounting plate 104 are prevented. It should be noted that the second position corresponds to the contact position of the present disclosure.

Moreover, as shown in FIGS. 6 and 7, a plurality of projections 115 (an example of a second contact portion of the present disclosure) are provided at an upper edge portion of



9

the main body portion **101** of the carriage **220**. In the present embodiment, four projections **115** are provided. Specifically, the projections **115** are provided at the center of a right upper edge portion of the main body portion **101**, at the center of a left upper edge portion of the main body portion **101**, and at both ends of the left upper edge portion in the longitudinal direction, respectively. The projections **115** project upward from the upper edge portion of the main body portion **101**. Specifically, the four projections **115** project upward such that projection ends of all of the four projections **115** are flush with each other. The projection ends of the projections **115** reach positions spaced apart from each other at predetermined intervals between the contact glasses **27** and **28** located above the carriage **220**. The projections **115** project upward further than the mounting plate **104**, the aluminum substrate **110**, and the printed substrate **111**, and project to positions beyond the mounting plate **104**, the aluminum substrate **110**, and the printed substrate **111**. In the present embodiment, the projections **115** project most on the upper surface of the carriage **220**. Since such projections **115** are provided, as shown in FIG. **11**, even if, during transportation of the image forming apparatus **10** in shipping the image forming apparatus **10**, the front end portion of the carriage **220** rotates upward about the support shaft **80** and comes into contact with the back surfaces of the contact glasses **27** and **28**, the projections **115** come into contact with the back surfaces of the contact glasses **27** and **28** prior to the mounting plate **104**, the aluminum substrate **110**, and the printed substrate **111**. That is, since the projections **115** come into contact with the contact glasses **27** and **28** at this position, the mounting plate **104** and the like do not come into direct contact with the contact glasses **27** and **28**. Thus, the mounting plate **104** and the like do not receive a shock caused by direct contact, and hence damage of the mounting plate **104** and the like and breakdown of the electric components which are components mounted thereon are prevented.

It should be noted that in the embodiment described above, the image reading device **11** is taken as an example of the image processing device of the present disclosure, but, for example, in the case where the moving body is an inkjet recording type recording head, the image processing device of the present disclosure may be an image processing device which performs an image recording process with the recording head. In addition, the image processing device of the present disclosure may be an image processing device including a moving body other than the carriage **220** and the recording head.

It is to be understood that the embodiments herein are illustrative and not restrictive, since the scope of the disclosure is defined by the appended claims rather than by the description preceding them, and all changes that fall within metes and bounds of the claims, or equivalence of such metes and bounds thereof are therefore intended to be embraced by the claims.

The invention claimed is:

1. An image processing device comprising:

a moving body composed of a resin member, the moving body having an upper surface on which a holding plate which holds an electric component used for image processing is mounted, the moving body being formed in a shape which is elongated in a longitudinal direction perpendicular to a predetermined moving direction;

10

a housing including a pair of side walls between which the moving body is housed therein;

a support portion provided to the housing, the support portion being configured to support the moving body such that the moving body is movable in a predetermined moving direction;

a contacted portion provided on an inner surface of each of the pair of side walls in the housing; and

a first contact portion provided to the moving body, the first contact portion being contactable with the contacted portion within the housing prior to the holding plate when the moving body reaches a contact position where it is possible to contact with the contacted portion, wherein

the first contact portion is provided on a side surface of the moving body at the moving direction side,

the contacted portion is a projection rib which projects from the inner surface of each side wall in a direction perpendicular to the inner surface and which is brought into contact with the first contact portion without being brought into contact with the holding plate when the moving body reaches the contact position,

the moving body includes a guide hole provided at one end thereof in the longitudinal direction and a supported portion provided at a lower surface at another end thereof in the longitudinal direction,

the support portion includes: a support shaft which is provided so as to extend between the pair of side walls and is inserted through the guide hole; and a support rail which is long in the moving direction and configured to support the supported portion such that the supported portion is slidable in the moving direction,

the image processing device further comprises:

a sheet placement plate which is mounted on an upper portion of the housing and on which a sheet member which is an image processing target is placed; and

a plurality of second contact portions provided to the upper surface of the moving body, the second contact portions being contactable with the sheet placement plate prior to the holding plate when the moving body rotates upward about the support shaft, and

the second contact portions are projections that are provided at a center of an edge portion at one side in a lateral direction of the moving body, at a center of an edge portion at the other side in the lateral direction of the moving body, and at both ends, in the longitudinal direction, of the edge portion at the other side, respectively, the second contact portions projecting upward from the upper surface of the moving body beyond the holding plate such that a predetermined gap is formed between the sheet placement plate and projection ends of the second contact portions.

2. The image processing device according to claim 1, wherein the first contact portion is a projection which projects from the side surface of the moving body in a direction perpendicular to the side surface and extends to a position beyond the holding plate.

3. The image processing device according to claim 1, wherein the moving body is a carriage of a reading unit configured to perform scanning in the moving direction to read a predetermined image during the image processing.

\* \* \* \* \*